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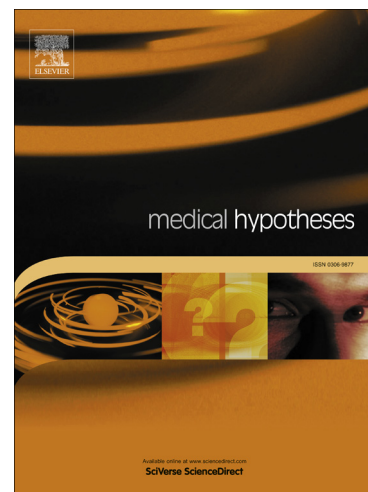
Weight of the liver and the spleen supplements inspirational activity

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Dear Editor,

Respiration in humans is an involuntary, synchronized activity of many organs in the thoracic cavity. The diaphragm, which divides the thorax and abdomen, plays a pivotal role in balancing the difference between abdominal and pleural pressure. The descent of the diaphragm is proportional to the magnitude of respiratory effect. The diaphragm is sufficiently thin to consider it as a membrane and its shape is determined based on many assumptions like transmembrane pressure and the stress imposed or borne on the direction of muscle fibre [1]. During inspiration, the volume of thoracic cavity is increased and it is reduced during expiration. Most explanations for this activity of having negative pressure in the thoracic cavity relates to simultaneous activation of the diaphragm and intercostal muscles, and elastance of the rib cage [1]. The experiments conducted at different laboratories have shown that during spontaneous inspiratory efforts, the intercostal muscles are always activated and the diaphragm is never maximally activated [1]. Isolated maximal diaphragm activation is a non-physiological maneuver that distorts the rib cage and the abdomen [1].

We hypothesize that the increase in lung capacity during inspiration is not only because of the aforementioned factors but also due to the weight of the liver and the spleen situated underneath the diaphragm that exert the pull on the diaphragm by gravitational force. The standing posture of humans also supplements the force exerted by these organs. Further studies are needed to explore the validity of the hypothesized statements.

Clinically, patients suffering from ascites have dyspnoea because the liver which is surrounded by fluid floats and thus has reduced weight because of which the patient has to put more efforts for inspiration [2]. Here, the same analogy is applied as for brain, which is surrounded by cerebrospinal fluid and floats thus reducing its weight. Hence, the focus of clinical management of patients with liver disorders with ascites should be aimed at reducing the ascitic fluid to overcome dyspnea instead of aiming at increased bronchial ventilation.

References

- [1] Wilson TA, De Troyer A. Diagrammatic analysis of the respiratory action of the diaphragm. *J Appl Physiol* 2010;**108**:251-5.
- [2] Kaltsakas G, Antoniou E, Palamidas AF, Gennimata SA, Paraskeva P, Smyrnis A, et al. Dyspnea and respiratory muscle strength in end-stage liver disease. *World J Hepatol* 2013;5:56-